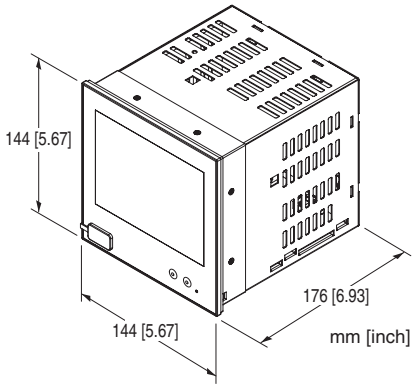
Paperless Recording System

PAPERLESS RECORDER

(5.7 inch LCD, touch panel, 16 points DC voltage input, 2 points dry contact, 2 points photo MOSFET relay output)

Functions & Features

• 5.7-inch TFT LCD display
• Touch panel enables operation by directly touching the screen
• IP55 front panel
• Records measurement data and operation status to internal memory (Storing to SD card is also possible)
• 100 msec. sampling rate
• SD card can be removed from the front
• Recorded data can be displayed and analyzed using the dedicated application
• DC voltage input, 16 points
• Discrete input 2 points, Photo MOSFET relay output 2 points
• Usable to trigger input and alarm output
• Graphic panel showing measurement status can be created



MODEL: VR144E-G16-[1]-[2][3]

ORDERING INFORMATION

• Code number: VR144E-G16-[1]-[2][3]
Specify a code from below for each of [1] through [3].
(e.g. VR144E-G16-1-R/C/HA/Q)
• Specify the specification for option code /Q
(e.g. /C01)

COMMUNICATION

E: Ethernet communication

I/O TYPE

G16: DC voltage input, 16 points,
NPN discrete input, 2 points,
Photo MOSFET relay output, 2 points
(For input range, refer to analog input specifications.)

[1] ANALOG INPUT RANGE

Select input range from the following.
1: DC input, 16 points (wide span voltage input, 16 points)
2: DC input, 16 points
(1 - 8 ch wide span voltage input, 8 points +
9 - 16 ch middle span voltage input, 8 points)
3: DC input, 16 points
(1 - 8 ch wide span voltage input, 8 points +
9 - 16 ch narrow span voltage input, 8 points)
4: DC input, 16 points (middle span voltage input, 16 points)
5: DC input, 16 points
(1 - 8 ch middle span voltage input, 8 points +
9 - 16 ch narrow span voltage input, 8 points)
6: DC input, 16 points (narrow span voltage input, 16 points)

[2] POWER INPUT

AC Power
MR2: 100 - 240 V AC (with AC adaptor)
(Operational voltage range 85 - 264 V AC, 47 - 66 Hz)
(Rated output 24 V DC 1A)
Note: Refer to the external dimensions for the plug shape as MR2 is intended for the EU market.
BR2: 100 V AC (with AC adaptor)
(Operational voltage range 100 V AC ±10%)
(Rated output 24 V DC 1A) (CE not available)
DC Power
R: 24 V DC
(Operational voltage range 24 V ±10 %, ripple 10 %p-p max.)

[3] OPTIONS (multiple selections)

ANALOG INPUT CONNECTOR
blank: Voltage input connector (1 row)
/C: Current input connector (2 rows)
(For current input, specify "/C" in order to connect a precision resistor module.
"/C" can be selected only when the analog input range is "1".
Prepare a precision resistor module (model: REM6-250) by user.)
INSTALLATION
blank: Panel mount type
/HA: Desktop type (with handle and rubber feet)
(Desktop type cannot be mounted on a panel surface.
The handle and rubber feet cannot be detached.)
Other Options
blank: none
/Q: With options (specify the specification)

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SPECIFICATIONS OF OPTION: Q

COATING (For the detail, refer to our web site.)
/C01: Silicone coating
/C02: Polyurethane coating
/C03: Rubber coating

RELATED PRODUCTS

- Precision resistor module (model: REM6-250)
- PC configurator software (model: VR144CFG)
- Viewer software (model: TRViewer)

Software downloadable at our web site.

- SD card

An SD card is required to store data in the device.
Use an SD card of the specified model number.
Consult us for purchase.
- Hagiwara Solutions MSDB-016GS(V01SLS

GENERAL SPECIFICATIONS

Construction: Panel mount type or desktop type
Degree of protection: IP55; applicable to the front panel for single device mounted according to the specified panel cutout (/HA: Desktop type cannot be mounted on a panel surface)

■ **Connection**

Power supply:

- **Power input is R:** Tension clamp terminal block (Front Twin connection)
  Applicable wire size: 0.2 - 2.5 mm^2, stripped length 10 mm
- **Power input is BR2, MR2:** AC adapter jack

Ethernet: RJ-45 modular jack
I/O: Tension clamp terminal block
Applicable wire size: 0.2 - 1.5 mm^2, stripped length 10 mm
FE terminal: M3 screw terminals (torque: 1.0 N·m)
Screw terminal: Nickel-plated steel
Solderless terminal: Refer to the recommended solderless terminal drawing.

- **Recommended manufacturer**: Japan Solderless Terminal MFG.Co.Ltd, Nichifu Co.,ltd
- **Applicable wire size**: 0.25 – 1.65 mm^2 (AWG 22 to 16)

■ **Housing material**

Case: Steel
Front bezel: Flame-resistant resin (black)
Front LCD filter: Transparent resin

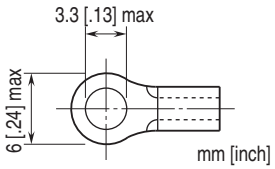
■ **Display**

Display device: 5.7-inch TFT LCD
Display colors: Approx. 260 000
Resolution: VGA 640 × 480 pixels
Pixel pitch: 0.06 × 0.18 mm
Backlight: LED
Backlight life: Approx. 50 000 hours
(The backlight can be replaced in our factory.
The LCD must be replaced at the same time.)
Screen saver standby time: 1 to 10 minutes
Display update interval: 100 msec.

■ **Others**

Isolation: Analog input to discrete input to discrete output to Ethernet or FE to power
Calendar clock: Year (4 digits), month, date, day, hour, minute, second
Output at the loss of communication: Hold the output (*), Reset the output
(*) Factory default setting

■**Recommended solderless terminal**



ETHERNET COMMUNICATION

Communication Standard: IEEE 802.3u
Transmission: 10BASE-T, 100BASE-TX
Baud rate: 10/100 Mbps (Auto Negotiation function)
Protocol: IP, TCP, UDP, ICMP, SNTP, HTTP, DHCP, SMTP, SMTPS, TLS, Modbus/TCP, SLMP, Modbus/TCP server, FTP server, FTP client, FTPS client
Transmission media: 10BASE-T (STP, Category 5)
100BASE-TX (STP, Category 5e)
Max. length of fieldbus segment: 100 meters
Ethernet indicator LED: ACT, LNK
IP address: 192.168.0.10 (factory setting)
Subnet mask: 255.255.255.0 (factory setting)
Default gateway: 192.168.0.1 (factory setting)

ANALOG INPUT SPECIFICATIONS

Input signal: DC voltage, 16 points

■ **Wide span voltage**

Input resistance: ≥ 1 MΩ
±10 V DC to ±0.8 V DC
Maximum input range: ±10.5 V DC

■ **Middle span voltage**

Input resistance: ≥ 100 kΩ
±0.8 V DC to ±80 mV DC
Maximum input range: ±0.84 V DC

■ **Narrow span voltage**

Input resistance: ≥ 100 kΩ
±80 mV DC to ±10 mV DC
Maximum input range: ±84 mV DC

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CONTACT INPUT SPECIFICATIONS

Contact input: Dry contact, 2 points
Common: Negative common per 2 points
Maximum inputs applicable at once: No limit
Rated detective voltage: Approx. 5 V DC (internal supply)
ON voltage / resistance: ≤ 0.5 V / ≤ 500 Ω
OFF voltage / resistance: ≥ 4.0 V DC / ≥ 20 kΩ
Input current: Approx. 3.8 mA
Input resistance: Approx. 1 kΩ
ON delay: ≤ 2.0 msec.
OFF delay: ≤ 2.0 msec.

OUTPUT SPECIFICATIONS

Photo MOSFET relay output, 2 points
Rated load voltage: 48 V peak AC / DC
Rated output current: 0.2 A per point
Output ON resistance: ≤ 1 Ω
Leakage current at open circuit: ≤ 0.1 mA
ON delay: ≤ 50 msec.
OFF delay: ≤ 1 msec.
(Recommended to protect the contact and to eliminate noise when driving an inductive load.)

INSTALLATION

Power consumption (contact I/O load charge is not included)
•**AC**:
≤ 15 VA at 100 V
≤ 20 VA at 200 V
≤ 22 VA at 240 V
• **DC**: ≤ 240 mA (24 V DC)
Operating temperature: -10 to +55°C (14 to 131°F)
Operating humidity: 30 to 90 %RH (non-condensing)
Allowable dust particles: 0.1 mg/m^2 (no conductive particles)
Corrosive gas: Not allowed
Mounting: Panel flush mounting (excluding desktop type)
Panel material: Steel
Weight: 1100 g (2.43 lb)

PERFORMANCE

Conversion accuracy: ±0.1 % (in percentage of max. span of input range)
Conversion rate: 100 msec.
Temp. coefficient: ±0.015 %/°C (±0.008 %/°F)
(in percentage of max. span of input range)
Calendar clock (with battery backup):
Accuracy: Monthly deviation of ≤ 2 minutes at 25°C or 77 °F
Back up period: Approx. 2 months
Battery: Lithium secondary battery (non-removable)
Insulation resistance: ≥ 100 MΩ with 500 V DC
Dielectric strength: 1500 V AC @ 1 minute
(analog input to discrete input to discrete output to Ethernet or FE to power)

STANDARDS & APPROVALS

EU conformity:
EMC Directive
EMI EN 61000-6-4
EMS EN 61000-6-2
RoHS Directive

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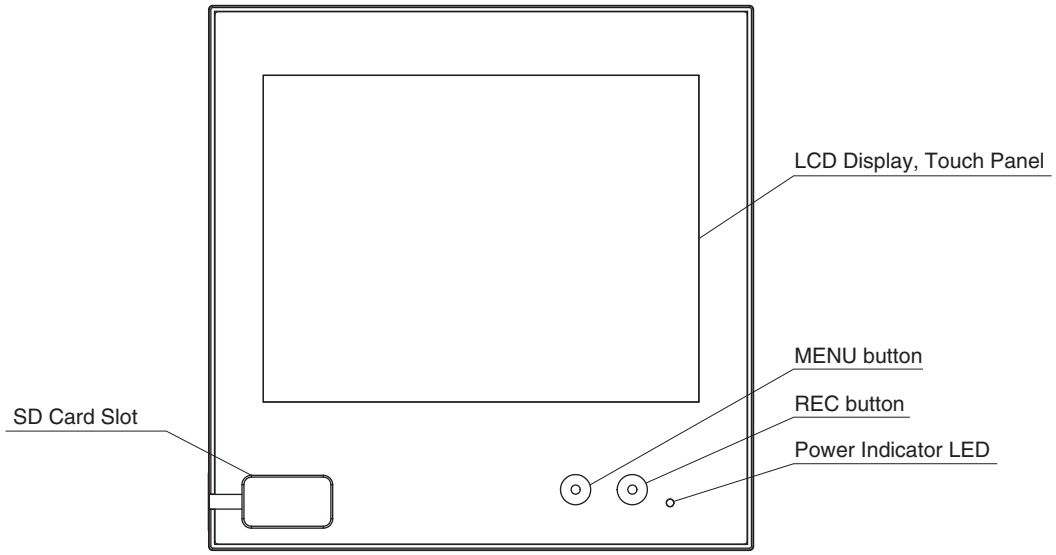
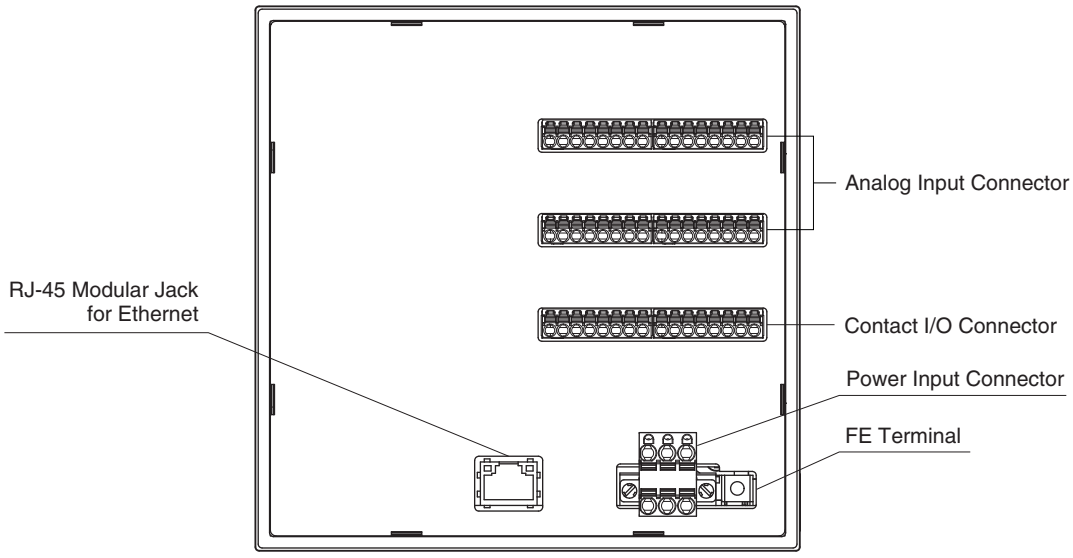
EXTERNAL VIEW

■ **FRONT VIEW**



■ **REAR VIEW**

• **Voltage input connector**
Power input code is R



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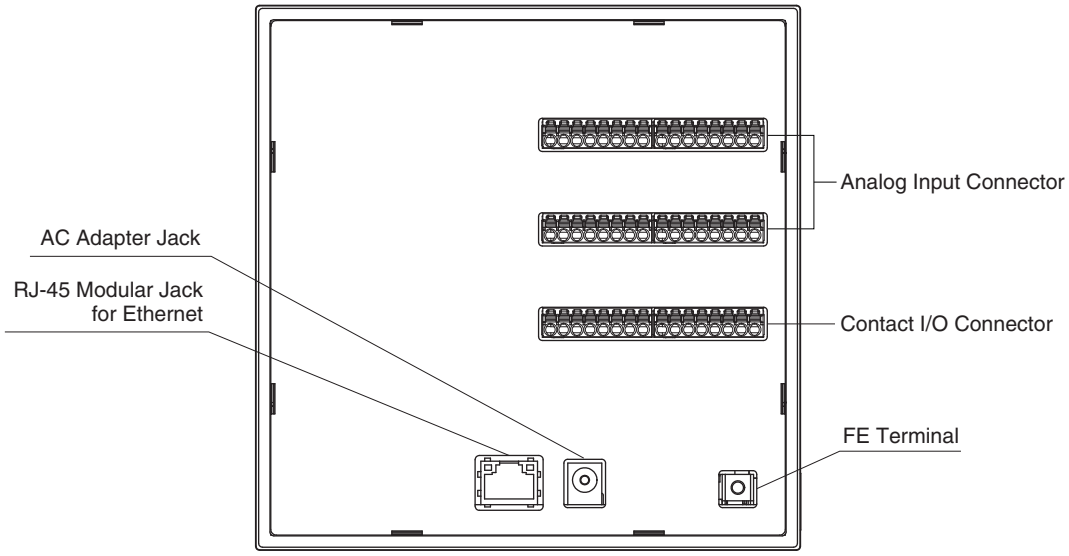
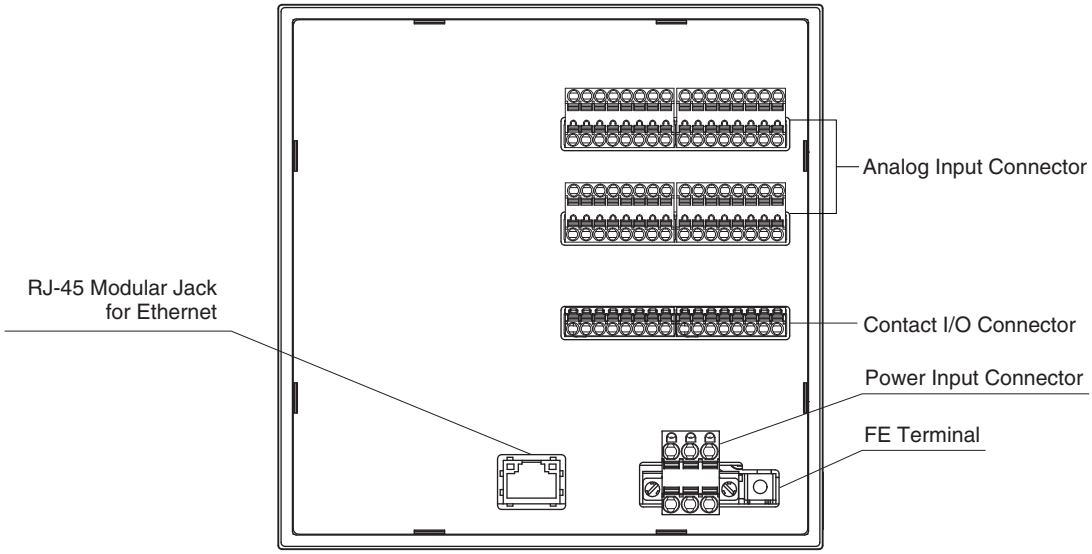
Power input code is MR2 or BR2



• Current input connector
Power input code is R



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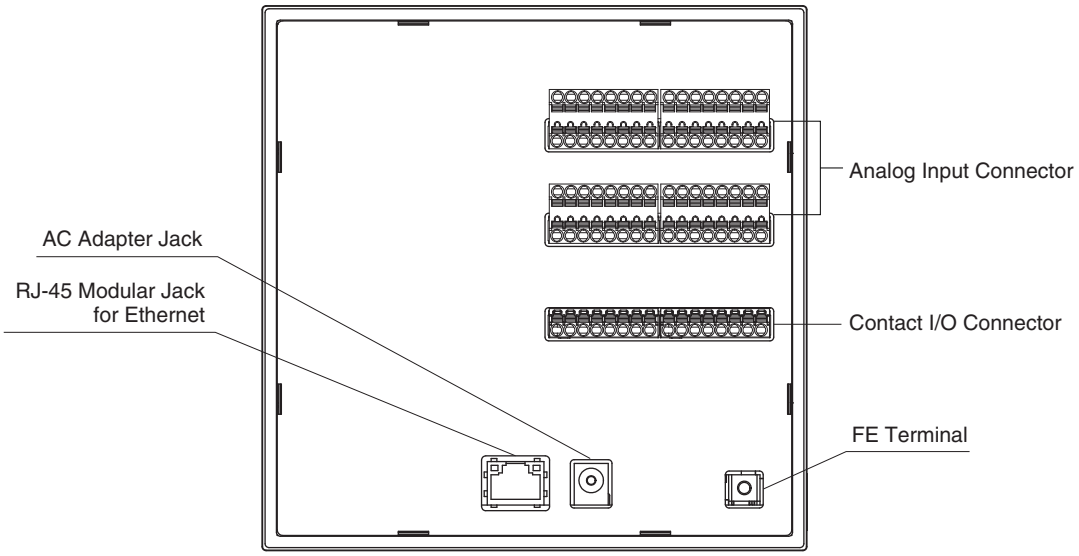
Power input code is MR2 or BR2



TERMINAL ASSIGNMENTS

■ **POWER SUPPLY TERMINAL ASSIGNMENT (Power input code is R)**

Device side connector: MSTB2,5/3-GF-5,08 (Phoenix contact)

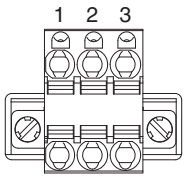
Cable side connector: FKCN2,5/3-STF-5,08 (Phoenix contact) included in the package

Applicable wire size: 0.2−2.5 mm²

Stripped length: 10 mm

Recommended solderless terminal:

AI0,25-10YE 0.25mm² (Phoenix contact)
AI0,34-10TQ 0.34mm² (Phoenix contact)
AI0,5-10WH 0.5mm² (Phoenix contact)
AI0,75-10GY 0.75mm² (Phoenix contact)
AI1-10RD 1.0mm² (Phoenix contact)
AI1,5-10BK 1.5mm² (Phoenix contact)
AI2,5-10BU 2.5mm² (Phoenix contact)

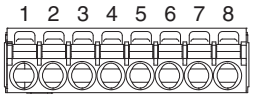


PIN NO.	ID	FUNCTION
1	24V	Power supply (24V DC)
2	0 V	Power supply (0V)
3	NC	No Connection

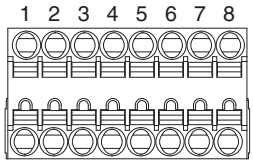
■ **ANALOG INPUT TERMINAL, CONTACT INPUT/OUTPUT TERMINAL ASSIGNMENT**

Device side connector: MC1,5/8-GF-3,5 (Phoenix contact)
Cable side connector: Included in the package
· Voltage input connector: FMC1,5/8-STF-3,5 (Phoenix contact)
· Current input connector: TFMC1,5/8-STF-3,5 (Phoenix contact)
Applicable wire size: 0.2−1.5 mm²
Stripped length: 10 mm
Recommended solderless terminal:
AI0,25-10YE 0.25mm² (Phoenix contact)
AI0,34-10TQ 0.34mm² (Phoenix contact)
AI0,5-10WH 0.5mm² (Phoenix contact)
AI0,75-10GY 0.75mm² (Phoenix contact)
A1-10 1.0mm² (Phoenix contact)
A1,5-10 1.5mm² (Phoenix contact)

Voltage input connector



Current input connector



• Analog input

PIN NO.	ID	FUNCTION
1	AI1+	Input 1+
2	AI1-	Input 1-
3	AI2+	Input 2+
4	AI2-	Input 2-
5	AI3+	Input 3+
6	AI3-	Input 3-
7	AI4+	Input 4+
8	AI4-	Input 4-
9	AI5+	Input 5+
10	AI5-	Input 5-
11	AI6+	Input 6+
12	AI6-	Input 6-
13	AI7+	Input 7+
14	AI7-	Input 7-
15	AI8+	Input 8+
16	AI8-	Input 8-

PIN NO.	ID	FUNCTION
1	AI9+	Input 9+
2	AI9-	Input 9-
3	AI10+	Input 10+
4	AI10-	Input 10-
5	AI11+	Input 11+
6	AI11-	Input 11-
7	AI12+	Input 12+
8	AI12-	Input 12-
9	AI13+	Input 13+
10	AI13-	Input 13-
11	AI14+	Input 14+
12	AI14-	Input 14-
13	AI15+	Input 15+
14	AI15-	Input 15-
15	AI16+	Input 16+
16	AI16-	Input 16-

• Contact input/output

PIN NO.	ID	FUNCTION
1	DI1	Contact Input 1
2	COM	Common
3	DI2	Contact Input 2
4	COM	Common
5	NC	No Connection
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	DO1	Photo MOSFET Output 1
10	DO1	Photo MOSFET Output 1
11	DO2	Photo MOSFET Output 2
12	DO2	Photo MOSFET Output 2
13	NC	No Connection
14	NC	No Connection
15	NC	No Connection
16	NC	No Connection

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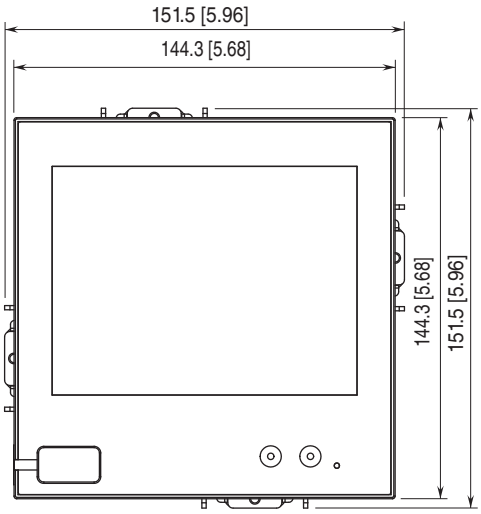
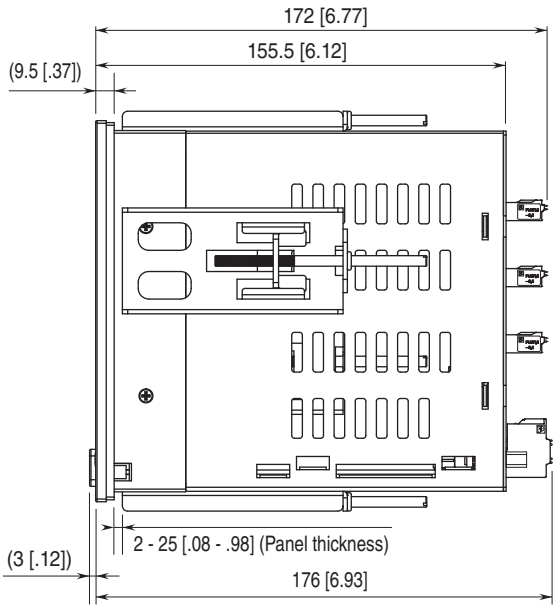
EXTERNAL DIMENSIONS unit: mm [inch]

■ **PANEL FLUSH MOUNTING**

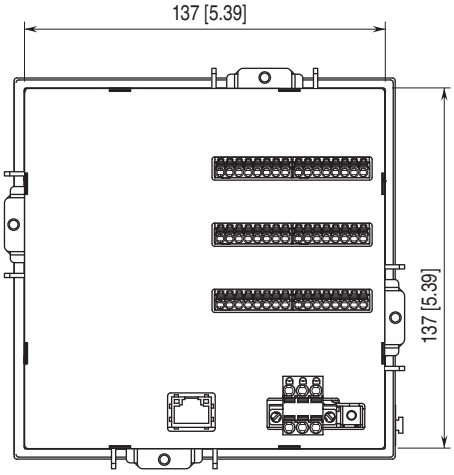
• **Front view**



• **Side view**



• **Rear view**



Note 1: The shape of rear connectors and other components differs according to the code number.
Note 2: The mounting brackets can be installed either vertically or horizontally.

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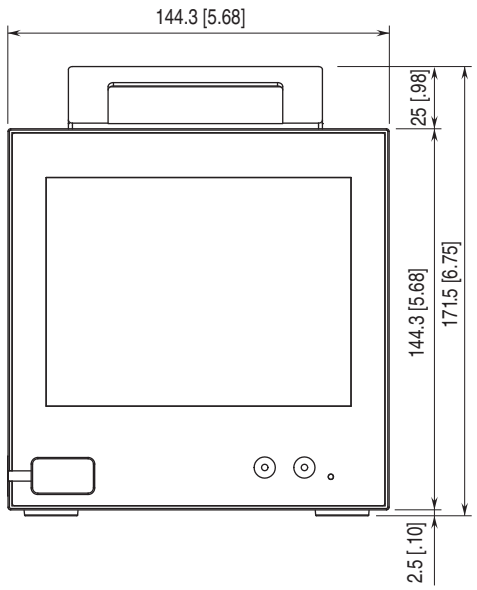
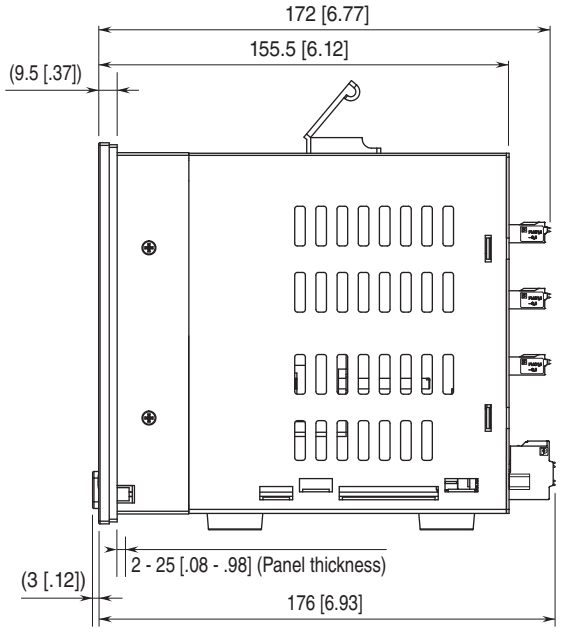
■ **DESKTOP TYPE**

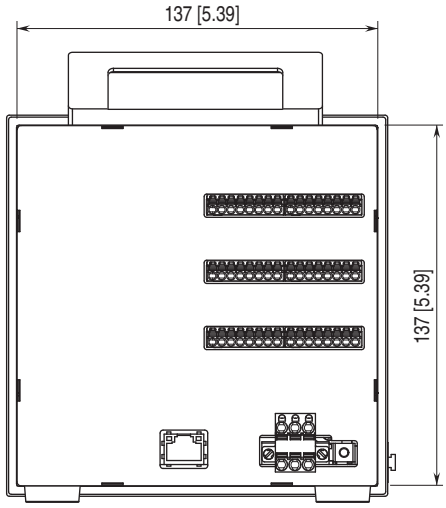
• Front view



• Side view



• Rear view



Note 1: The shape of rear connectors and other components differs according to the code number.
Note 2: The mounting brackets can be installed either vertically or horizontally.

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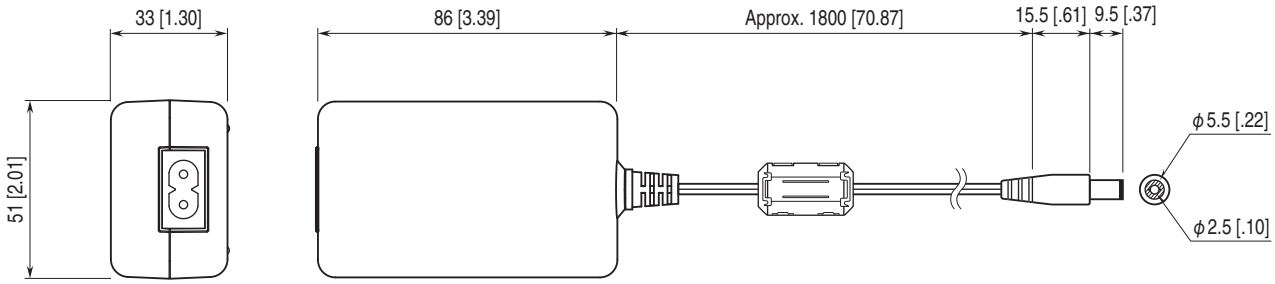
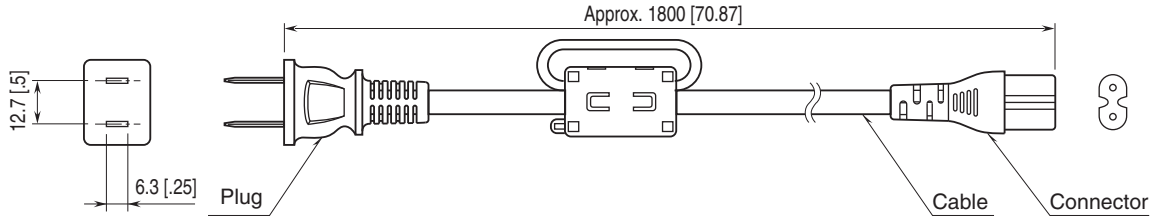
■ **AC adapter**

• **Device**

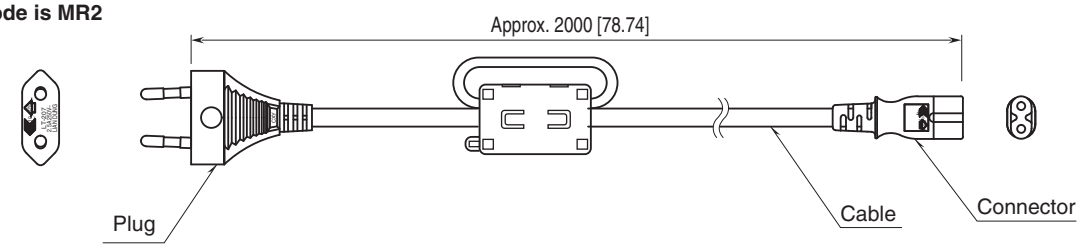


• **Cable**

Power input code is BR2



Power input code is MR2



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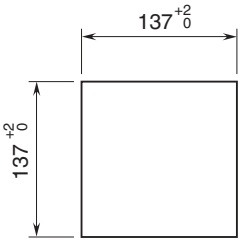
PANEL CUTOUT unit: mm

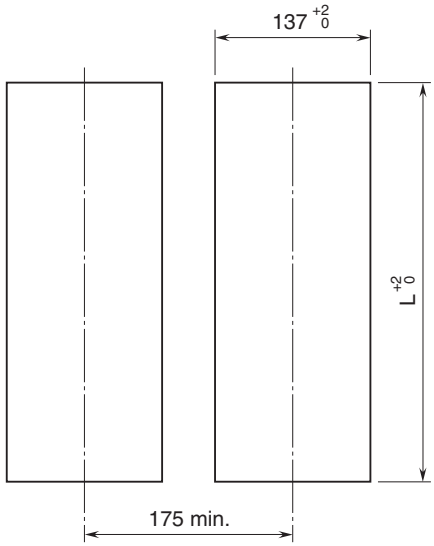
Usable panel thickness: 2 – 26 mm [0.08” – 1.02”]

■ SINGLE MOUNTING

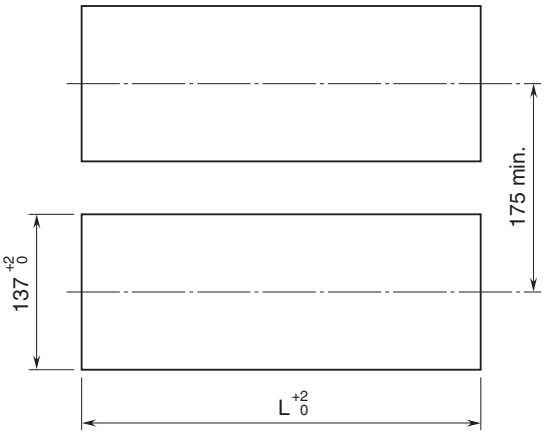


Number	L +2 0 (mm)
2	282
3	426
4	570
5	714
6	858
7	1002
8	1146
9	1290
10	1434
n	(114 × n) – 6

■ VERTICAL CLUSTERED MOUNTING (max. 3 units)



■ HORIZONTAL CLUSTERED MOUNTING



Note: Desktop type cannot be mounted on a panel surface.

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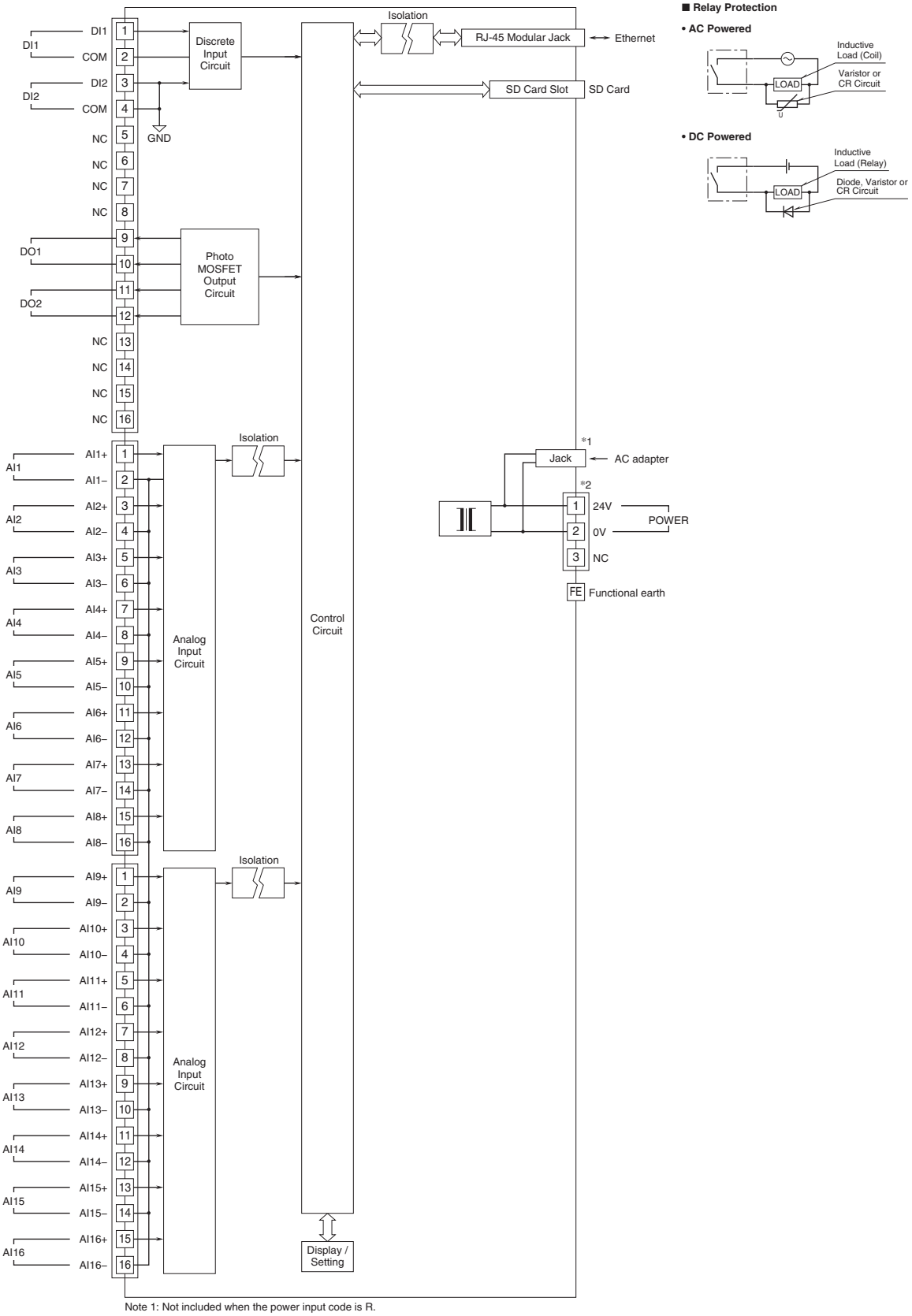
SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

Note: In order to improve EMC performance, bond the FE terminal to ground.

Caution: FE terminal is NOT a protective conductor terminal.



Note 1: Not included when the power input code is R.
Note 2: Not included when the power input code is MR2 or BR2.

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INPUT/OUTPUT FUNCTION

Selectable I/O signals among built-in I/O and remote I/O.

- Analog input (AI): max. 64 points
- Discrete input (DI): max. 16 points
- Discrete output (DO): max. 16 points
- Operational input (OI): max. 32 points

SCREEN DISPLAY

■ **Trend view**

Direction: Horizontal
Number of display points: 4/8 per view
Number of display views: 16
Maximum number of samples: 560

■ **Bargraph view**

Direction: Vertical
Number of display points: 4/8 per view
Number of display views: 16
Displayed content: Name, comment, value, unit

■ **Overview**

Number of display points: 16/32/64/128 per view
Number of display views: 8
Displayed content: Name, comment, value, unit

■ **Digital view**

Number of display points: 8 per view
Number of display views: 16
Displayed content: Name, comment, value, unit, bargraph

■ **Log view**

Number of displayed events: 10 per page (display the latest 40 events)
Number of display views: 4 (event log, system log, communication log)

■ **Graphic panel view**

Number of display points: 96 per view
Number of display views: 2
Displayed content: 64 items from name, comment, value, unit, bargraph and LED
32 items from character strings
Background image: *, bmp (640 × 456)

■ **Maintenance view**

Used to perform setting and maintenance.

■ **Screen saver**

Back light can be turned off if there is no operation for a certain period of time.

■ **Auto view switching**

Views can be switched automatically if there is no operation for a certain period of time.

TREND DATA STORING

Trend data, event data and comment data are recorded in memory blocks and then transferred to the SD card at the specified time intervals.
Recording method is selectable from normal recording or trigger recording.

■ **Number of memory blocks**

64 blocks

■ **Memory block transition timing**

When 50 000 events of trend data are recorded and at SD card writing timing

■ **Recording method**

- **Normal recording:** Recording continuously until recording is manually stopped.
- **Trigger recording (edge):** Recording up to 1200 samples of data before and after the trigger condition is met, respectively.
- **Trigger recording (level):** Recording data during the trigger condition is met.

■ **Sampling rate**

- 100 ms

■ **Storing rate**

- 100 ms, 500 ms, 1 sec., 2 sec., 5 sec., 10 sec., 1 min., 2 min., 5 min., 10 min., 30 min., 1 hour

■ **Trend data**

- **Number of channels:** Max. 64 (select from AI, DI, DO, OI)
- **Number of events:** Max. 50000
  sample × number of channels (per file)

■ **Event data**

- **Event:** Zone transition for AI and OI,
  change of DI status
- **Recorded content:** Time, event
- **Number of events:** 3000 (per file)

■ **Comment data**

- **Maximum number of input characters:** 32
- **Recorded content:** Time, comment
- **Number of events:** 1000 (per file)

■ **SD card writing timing**

STORING RATE	SD CARD WRITING TIMING
100 ms	10 min., 30 min., 1 hour
500 ms	30 min., 1 hour, 6 hours
1 sec.	1 hour, 6 hours, 12 hours
2 sec.	1 hour, 6 hours, 12 hours, 1 day
5 sec.	6 hours, 12 hours, 1 day
10 sec.	6 hours, 12 hours, 1 day
1 min.	1 day, 1 week
2 min.	1 day, 1 week
5 min.	1 day, 1 week, 1 month
10 min.	1 day, 1 week, 1 month
30 min.	1 day, 1 week, 1 month
1 hour	1 week, 1 month

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■ Data format
Dedicated format (binary, extension “TRD”) or CSV format (UTF-8/SJIS).

■ Data file name
Files are named YYYYMMDDhhmmss when saved to the SD card.
e.g.)
Dedicated format:
20240611100000000.TRD
CSV format:
20240611100000_T.CSV (trend)
20240611100000_E.CSV (event)
20240611100000_C.CSV (comment)

■ Auto deleting function
• When the function is disabled, recording is possible until the SD card's storage capacity is exhausted.
• When the function is enabled, if the SD card's storage capacity falls below 100MB, the oldest data will be deleted (excluding the data from the past 4 years).

■ Writing period
Approx. recording time period for TRD format with a 16 GB SD card

STORING RATE	16 PENS	32 PENS	64 PENS
100 ms	8 months	4 months	2 months
500 ms	2 and a half years	1 year	6 months
1 sec.	4 years	2 years	1 year
2 sec.	8 years	4 years	2 years
5 sec.	10 years	10 years	7 years
10 sec.	10 years	10 years	10 years
1 min. – 1 hour	10 years (max.)		

Note 1) Only the trend recording is enabled.

Approx. recording time period for CSV format with a 16 GB SD card

STORING RATE	16 PENS	32 PENS	64 PENS
100 ms	120 days	60 days	30 days
500 ms	20 months	10 months	5 months
1 sec.	3 years	1 and a half year	10 months
2 sec.	6 years	3 years	1 and a half year
5 sec.	10 years	8 years	4 years
10 sec.	10 years	10 years	8 years
1 min.– 1 hour	10 years (max.)		

Note 2) Only the trend recording is enabled. (The values are calculated as 8 single-byte characters)

■ Viewer software
The data stored in the SD card can be displayed on dedicated Viewer Software (model: TRViewer). Also, data can be converted to CSV format file.

LOGGING

Data can be recorded in the internal memory when an event occurs. Increased data can be transferred to the SD card when data is finalized or every 1 minute.

■ Event log
Recording zone transitions for AI and OI, and events occurred when DI status changes.

■ System log
Recording a history of operations of the device, such as turning the power ON, time adjustment, or updating the setting.

■ Communication log
Recording a history of communications of the device such as SMTP (mail) or FTP client.

■ Number of memory blocks
8 blocks for each log (1000 events per block)

■ Memory block transition timing
When 1000 events are recorded and at the change of year

■ Data format
txt format (.txt)

■ Log file name
Files are named YYYYMMDDhhmmss when finalized the data.
e.g.)
20240611100000E.txt (event log)
20240611100000S.txt (system log)
20240611100000C.txt (communication log)

COMMUNICATION

■ IP
DHCP client function is supported. Manual setting of IP address, subnet mask, default gateway and DNS server is also available.

■ Modbus/TCP client
It is possible to connect to remote I/O such as R3 or R7, etc., enabling the expansion of I/O. Moreover, it can handle data from measuring points in multiple locations.

• Connected products
R3-NE1, R3-GE1
R5-NE1
R6-NE1, R6-NE2
R7E series
R30NE1
72EM2-M4
GR8-EM
DL8 series
DL30 series
TR30-G
IT series

■ SLMP client
It is possible to connect to the SLMP-compatible CPU unit of Mitsubishi programmable-controller MELSEC, enabling the expansion of I/O. Moreover, it can handle data from measuring points in multiple locations.

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• **Connectable model:**
MELSEC iQ-R series
MELSEC iQ-F series
MELSEC Q series

■ **Max. number of connectable devices (Number of servers)**
8 connections (selectable from Modbus/TCP or SLMP)
Establishing connections for number of slaves connected.
Note) The number of connectable devices may depend on the specifications of each device.

■ **Modbus/TCP server**
2 connections
I/O data can be monitored by remote SCADA.

ALARM OUTPUT

DO designated as alarm contact output can be turned ON at event occurrence.

■ **Event**
• Zone output of AI, DI, OI
• Communication failure in e-mail reporting, FTP client, Modbus/TCP and SLMP

EVENT REPORTING E-MAIL

E-mail reporting function is available at event occurrence or at the specified time.
Encrypted communication is supported. (SMTP over SSL)
Selected DO can be turned on after sending an e-mail.
• **Number of e-mail recipients:** 16
• **Number of event reporting messages:** 32
• **Number of regular reporting messages:** 32
• **Channel status:** AI, DI, OI, DO data status can be included in a mail.

FTP CLIENT

Files stored in the SD card can be uploaded to an FTP server.
• Supports FTPS (Explicit mode)

FTP SERVER

Reading and deleting files in the SD card by an FTP client is available.
Simultaneous connection: 1
Operation verified FTP client: FFFTP

TIMEKEEPING

■ **SNTP client**
• The recorder's internal time can be adjusted automatically.
• Time adjustment is performed when the power is turned on and at the specified time.

OTHER FUNCTIONS

■ **Maintenance**
The dedicated configurator software (model: VR144CFG) is used to configure the device.

■ **Setting file**
It is possible to save the settings of the device and network to an SD card as a configuration file (vr144cfg.json) and a network configuration file (vr144net.json).
It is possible to configure the device by reading the configuration file in the SD card.

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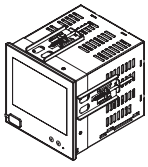
SYSTEM CONFIGURATION EXAMPLES

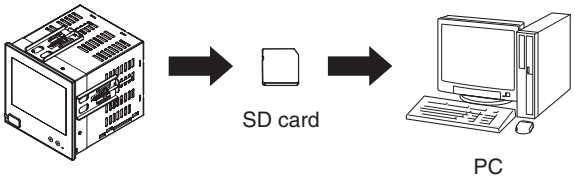
■ **STAND-ALONE**

• When the device is used alone



Paperless Recorder
(model: VR144E-G16)

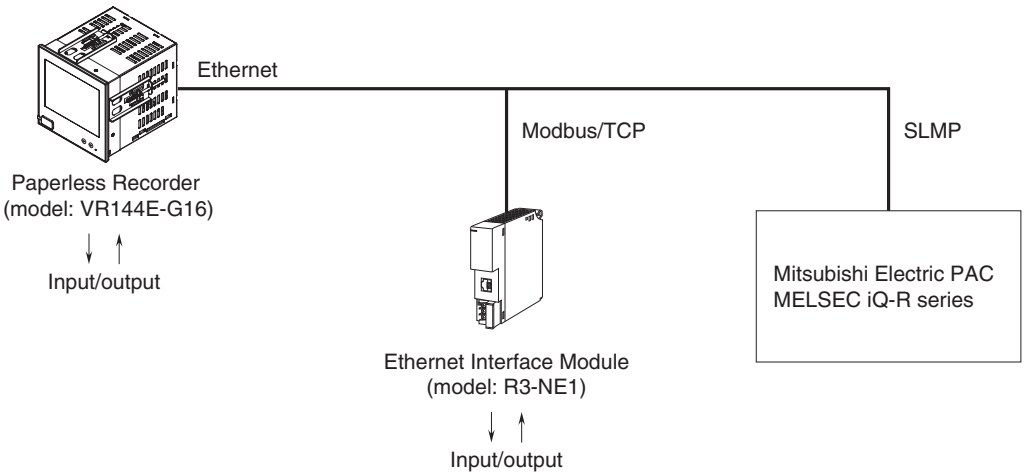
• When reading data from SD card



Paperless Recorder
(model: VR144E-G16)

PC
Viewer software
(model: TRViewer)

■ **R3 series I/O module and Mitsubishi Electric PAC are used (LAN)**



⚠ Specifications are subject to change without notice.

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